

## CHAPTER 8

### HOT WORK

8-1. **GENERAL.** Hot work in the context of gas free engineering includes the following:

- Flame heating, welding, torch cutting, brazing, or carbon arc gouging.
- Any operation producing temperatures of 204.4 degrees C (400 degrees F).
- Any operation occurring in the presence of flammable materials or in a flammable atmosphere which requires the use or presence of an ignition source. Examples of such work include the following:

- Spark-producing or static discharge.
- Friction.
- Open flames or embers.
- Impact.
- Nonexplosion-proof equipment (such as lights, fixtures, or motors).

#### CAUTION

When open flame or heat producing work such as welding, cutting, or brazing is to be conducted, the worksite, regardless of the location, is to be inspected by the gas free engineer or safety NCO.

8-2. **APPLICATION.** The provisions in this chapter apply to all hot work performed in confined or enclosed spaces, machinery rooms, bilges, and other locations proximate to flammable atmospheres (such as near fuel tank vents and sounding tubes). This chapter also applies to hot work performed on closed structures or containers such as pipes, drums, ducts, tubes, jacketed vessels, and similar items.

8-3. **CLEANING AND VENTILATING FOR HOT WORK.** Before hot work is begun in a confined or enclosed space, the space shall be tested, inspected, emptied of flammable cargo, cleaned, ventilated, and certified safe for hot work. Extraneous flammable or combustible materials such as scrap wood, paper, ropes, or rags shall be removed from the space. Combustible materials that cannot be removed shall be adequately protected. Ventilation ducting shall be made of noncombustible metal, of flexible construction, and free from hazardous combustible residues.

8-4. **FIRE WATCH.** When open flame or heat-producing work such as welding, cutting, or brazing is to be conducted, establish a trained fire watch at the worksite. When hot work may transmit fire hazards to other spaces by overheating the connecting deck, overhead, or bulkheads, provide fire watches on both sides of the hot deck, overhead, or bulkheads. Fire watch communications will enable the fire watch to report hazardous conditions on the opposite side of separating structures and provide a signal to stop hot work. Fire watches on both sides of the separating structure shall have, and know how to use, fire extinguishing equipment suitable to the exposure. Fire watches shall be equipped with personnel protective equipment as required for the

operation being conducted (such as goggles, helmet, approved respiratory protective devices, and fire retardant clothing). After completion of the hot work operation, fire watches shall remain on station for a minimum of 30 minutes, ensure the area is cool to the touch, and that no smoldering embers remain.

8-5. **FIRE EXTINGUISHING EQUIPMENT.** Fire extinguishing equipment shall be provided which is suitable for the nature and amount of flammable or combustibles present. Never use vaporizing liquid extinguishers in confined or enclosed spaces. Use PKP and CO<sub>2</sub> extinguishers only after determining that the extinguisher is appropriate for the exposure. Also determine whether the displacement of oxygen by discharge of CO<sub>2</sub> into the space is likely to cause a hazard to personnel. Water extinguishers or firehoses equipped with vari-nozzles, fog nozzles, or fog applicators are the most suitable fire extinguishing equipment for hot work in the presence of ordinary (class A) combustible material, flammable residues, coating, or insulation. Evaluate fire extinguishing equipment for the following:

- Ability to suppress the fire.
- Hazards that the extinguishing agent might create in the space.
- Capacity of the equipment compared to the fire potential. Firehoses equipped with a vari-nozzle, fog nozzle, applicator, or portable fire extinguisher are acceptable. The nature of the space or ship may restrict selection of fire equipment.

NOTE

Class A combustibles are those which leave embers and must therefore be cooled throughout the entire mass.

8-6. **HOT WORK LOCATIONS.** Prior to beginning hot work, an assessment of potential hazards must be made at each location. The following, although not all inclusive, provides guidance regarding what hazards to expect.

a. **Boundary Spaces.** When hot work is to be performed on fuel tanks, associated vent spaces, or other spaces containing flammables (such as paint lockers and flammable liquid storerooms), the adjacent spaces above, below, and on all sides (boundary spaces) shall first be inspected and tested, cleaned, and ventilated or inerted as appropriate, then certified **SAFE FOR HOT WORK**.

b. **Pipes, Tubes, and Coils.** Hollow connections to a space can present the same hazards as the space itself. Pipes, tubes, and coils or similar items which service, enter, or exit a confined or enclosed space shall be flushed, blown, purged, or otherwise cleaned and certified **Safe for Hot Work** before the performance of hot work on such items. If not so treated and certified, the certificate for the space shall be marked **Not Safe for Hot Work**. Valves to pipes, tubes, or similar items shall be dosed, the pipes blanked off, and tagged out, following the provisions of the Ship's Tagout Procedures, to prevent inadvertent discharge or backflow of materials into the space.

c. **Hot Work on Closed Containers or Structures.** Prior to beginning hot work on hollow structures, drums, containers, jacketed vessels, or similar items, the items shall be cleaned, flushed, purged, inerted, tilled with water, or otherwise made safe. The items shall be inspected, cleaned, tested, and certified before performing hot work. Items which are dosed and subject to pressure buildup from any application of heat shall be vented to relieve any pressure created by the hot work. The method of venting shall be selected to prevent ignition or explosion during the venting process.

d. **Hot Work Near Preservative Coatings.** Characteristics of a particular coating determine the procedures and precautions for hot work near that coating.

e. **Flammable Coatings.** Flammable coating hot work requirements areas follows:

- Determine the flammability of coatings before starting hot work. Remove combustible coating from the hot work area to a distance sufficient to prevent ignition or outgassing (from temperature increase) at least 4 inches on all sides from the outer edge of the hot work.
- Never use flame or uncontrolled heat for stripping flammable coating.
- Test continuously for flammable atmospheres during hot work. Where significant outgassing is detected, stop hot work and further strip the coating. Start artificial cooling methods, such as wetting down, to prevent temperature increases in the unstrapped areas.
- Shield flammable coatings from slag or sparks in the area of the hot work. Wet down surrounding areas or cover with netted fire retardant cloth.
- Ventilate area, if applicable.
- At a minimum, keep a 1-inch firehose with a vari-nozzle, fire nozzle, or fog applicator in the immediate vicinity, charged, and ready for instant use, except where prohibited by the nature of the space or ship.

f. **Toxic Coatings.** Before hot work, strip any coating which becomes toxic when heated to at least 4 inches beyond the area that will be heated. Equip personnel with airline respirators or equivalent respiratory protection. Ventilate to remove toxic fumes or vapors from the space.

g. **Hot Work Near Damaged Surfaces.** Tank walls and coating deformities may carry toxicants and other hazards. Blisters, scales, and similar formations inside tanks that have held flammable materials may, even after cleaning and ventilating, hold flammable residues. Consider the following when planning hot work

- Determine whether any previous tank contents may have left hazardous residues.
- Assess the possibility of a surface flash which would involve the entire space.

h. **Clean Scales or Blisters.** Consider the following when cleaning scales or blisters.

- Remove scales or blisters which contain highly flammable residues (flashpoint 37.8 degrees C (100 degrees F) such as gasoline or JP-4 fuel) from the entire space before hot work.
- Clean away scales or blisters containing less flammable residues (flashpoint above 37.8 degrees C (100 degrees F) such as fuel oil or JP-5 fuel) to a distance of 4 inches on all sides from the outer edge of the hot work. In all cases, the area cleaned shall be sufficient to prevent outgassing from surrounding areas and to prevent ignition of residues.
- Clean or protect areas below the hot work. Use screens, fire retardant cloth, or devices to capture sparks and slag.

- Wet down areas around hot work to reduce the residue vaporization and to prevent small fires and flashes.
- Assign fire watches with equipment to extinguish any resulting fire.

i. **Hot Work Near Pressurized Systems.** Before beginning hot work, repressurize nearby pressurized systems (such as hydraulics or Freon). Protect piping, fittings, valves, and other system components from contact with flames, arcs, slag, or sparks. Clean space and remove contaminants before hot work.

**WARNING**

When subjected to high temperatures, hydraulic fluid can decompose and produce highly toxic by-products. Noncombustible insulation such as fiberglass may have combustible backing or adhesive materials.

j. **Hot Work Near Insulation.** Conduct hot work carefully near combustible insulation. Some insulation materials may be ignited by welding, slag, or other short-duration exposure to ignition sources. Foam insulation materials are particularly likely to ignite and generate toxic combustion gases. The following are procedures for hot work near insulation:

- Remove insulation from the area of hot work.
- Wet down nonremovable insulation with water then cover the insulation with watersoaked, fire-retardant cloth.
- Station a fire watch with a charged 1-inch firehose, ready for use in the immediate area.

k. **Hot Work Near Ammunition and Explosives.** The following procedures are for hot work near ammunition or explosives:

- Remove ammunition and explosives from the area of hot work.
- Ventilate the area of the hot work.

8-7. **HAZARDOUS BY-PRODUCTS.** Welding, cutting, heating, or burning in the presence of certain materials (such as adulate fluids, Freons, chlorinated solvents, or halons) can cause decomposition and produce hazardous by-products. Ensure that hot work is not conducted on or near such materials. Keep welding or cutting operations, which produce high levels of ultraviolet radiation, at least 200 feet from exposed chlorinated solvents.

8-8. **GAS WELDING AND CUTTING OPERATIONS.** The following shall be observed when performing gas welding or cutting operations.

a. **Compressed Gas Cylinders.** Transport, handle, and store compressed gas cylinders in accordance with the Code of Federal Regulations. Keep compressed gas cylinders or gas manifolds, used in welding and cutting operations, out of confined or enclosed spaces. Place them outside the space in open air, away from any fire, explosion, or emergency situation. Station an attendant, who

shall in an emergency, immediately turn off the gas supply from the compressed gas cylinders or gas manifolds.

b. **Gas Welding and Cutting Equipment.** Follow the procedures outlined in applicable manuals to inspect, test, operate, and maintain gas welding and cutting equipment such as hoses, connections, and torches. Remove torches and hoses from the space at work-crew change and at night. Remove open-ended hoses immediately after disconnecting torches or other devices from the hose.

c. **Gas Supplies.** Turn off gas supplies at the cylinder or manifold outside the space when equipment is unattended or unused for substantial periods of time. These include during breaks, lunch periods, work-crew changes, or overnight.

d. **Electric Arc Equipment.** Inspect, test, operate, and maintain electric arc equipment in accordance with the Code of Federal Regulations and appropriate manuals. Personnel engaged in electric arc welding repairs should be aware that the welder cabling produces strong magnetic fields during operation. Welding cables should be routed a minimum of 6 feet from sensitive electronic equipment such as radio or navigation equipment.

e. **Electrode Holders.** When electrode holders are left unattended, such as at breaks or during lunch periods, remove the electrodes from their holders. Place holders in a safe location and open the power switch to the equipment. If unattended for longer periods, such as overnight, remove electrode holders, cables, and other equipment from the space and disconnect the power supply to the equipment.

f. **Inert Gas Welding Process.** When using inert gases for welding, supply sufficient oxygen to the confined or enclosed space. Remove inert gasses discharged into the space during the operation and provide adequate makeup air. Inspect hoses, connections, and fitting for leaks. Position inert compressed gas sources outside the space and turn off at the source when equipment is unattended even for short periods. If unattended for extended periods, such as overnight, remove or disconnect the hoses and torch equipment and turn off the gas supply at the source.